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Anemone nemorosa, *Arabis lævigata*, *Barbarea vulgaris*, *Callitriche verna*, *Proserpinaca palustris* and *pectinacea*, *Hydrocotyle umbellata*, and *Sagittaria*. On the trunks of the fine elms along the streets is found, very abundantly, *Polypodium incanum*, its root-stocks creeping over the bark, and covering them with its delicate fronds to a height of twenty feet. Though apparently dry and dead, upon being brought home and placed in a fernery, the fronds began to expand and some new ones were seen putting forth. A later trip would doubtless reveal many more species, but with the drawback of possible chills and certain yellow flies and mosquitoes.

INJURIOUS AND BENEFICIAL INSECTS.

BY A. S. PACKARD, JR.*

THOUGH the reporter was absent during most of the past season, and was unable, except in a slight degree, to make any special investigations on the habits of our more injurious insects, yet with the help of others some new material is here offered that may be serviceable to farmers and gardeners. The facts that we have to present may often seem disconnected and desultory, but few except experts in natural history are perhaps aware how difficult and prolonged a task it is to follow out the transformations of any particular insect, and study thoroughly its habits in its different stages of growth. Unlike birds, quadrupeds and fishes, which have similar habits at all stages of growth, an insect, with its three separate stages of larva, pupa and adult, leads as it were three lives, with different surroundings, and in each of those stages may be regarded as a different animal. Then it is often extremely difficult to ascertain to what beetle or moth or bee such or such a grub or caterpillar belongs. Our entomologists are not numerous enough, and often from their time being taken up with the pursuits of their profession, usually not that of science, are unable to spend the time in the field to observe the

*Third Annual Report on the Injurious and Beneficial Insects of Massachusetts, being a reprint, with corrections, from the 20th Annual Report of the Secretary of the Massachusetts Board of Agriculture, 1873.

habits of insects for themselves. Unfortunately, also, so backward is the science of entomology in this country, that the attention of its students is at present fully engrossed with classifying and describing the adult insects. When it is to be borne in mind that there are within the limits of the United States, probably at a low estimate, ten thousand species of *Hymenoptera* (bees, wasps, ichneumon flies, saw-flies, etc.), half as many butterflies and moths, about ten thousand species of flies, as many of beetles (*Coleoptera*) and of bugs (*Hemiptera*), and several thousand species of grasshoppers, etc. (*Orthoptera*), and neuropterous insects, such as dragon-flies, caddis-flies, etc., etc., the whole amounting to upwards of fifty thousand species of insects, to say nothing of the spiders, mites and ticks, centipedes and millepedes, it is evident that in the mere preliminary work of identifying and properly describing these myriad forms—an intellectual work requiring as much good sense, discretion and knowledge as shown in the pursuit of medicine, the law or education,—that all this work, which is simply preliminary in its nature, is a vast one, and that the combined exertions of many minds over several generations will not exhaust the subject. As it is, there are in this country only about thirty entomologists who publish anything relating to insects. Necessary as it is, this work of classification is by no means the highest and most useful branch of physical science. He who studies carefully the habits and structure of one insect, and, if injurious to agriculture, lays before the farmer and gardener a true story of its mode of life, is a true benefactor to agriculture, and at the same time benefits science more than he who describes hundreds of new species. Such an one was Dr. Thaddeus W. Harris, whose leisure moments were consecrated to the benefit and advancement of the agricultural interests of our state, and the commonwealth perhaps never made a better investment than in supplying the agricultural community with an illustrated edition of his immortal work. On looking over Dr. Harris's work we find that he mentions about six hundred species as injurious to vegetation, and as others have been added since then, it is not improbable that we have at least one thousand destructive species, *i. e.*, about one-tenth of the entire number (10,000) of insects which undoubtedly are to be found living within the limits of this state. As to the losses sustained from their attacks it would be difficult to say how great they are, but it

is to be estimated at least by hundreds of thousands of dollars. The amount of waste by the agency of insects is really appalling, and even now but slightly appreciated by our farming community.

We have perhaps little idea how many insects are preying upon our crops, our shade and ornamental trees. There are, probably within the limits of our country, one-tenth of the number, *i. e.* five thousand, which are either at present engaged in the work of injury, or are destined to be, with the growth of civilization, which means in this instance the destruction of the natural food of these insects and the substitution of a different diet, our choicest grains and fruits, in their stead.

During the last summer the canker-worm was as destructive as ever, and it seems to have gained a firm foothold among us. It is scarcely creditable that so conspicuous and comparatively easily assailed an insect as this does so much annual damage. It would seem as if the birds did not feed upon it to much extent. We have personally never seen birds feeding upon the canker-worm, though Professor Wyman states that doves eat them sometimes in large numbers and it is thought that the crow blackbirds pick up the caterpillars. As we have stated in a former report there are certain kinds of caterpillars that birds do not relish. Indeed birds seem to have certain fancies of their own among edible insects. Thus the martin will store up in its nest quarts of the common striped beetle of the potato, to the exclusion of other insects.

The reporter would be greatly obliged for any facts upon this subject communicated by those who may have a chance to observe what birds feed on particular kinds of insects and at what season and month of the year.

Our cranberry crop has been grievously ravaged during the year past, though the writer has no information to give at present in relation to this subject farther than that recorded in the article entitled "New and Little Known Insects," in the "Report on Agriculture of the State for 1870," and that given in the author's "Guide to the Study of Insects," though he has visited several cranberry pastures during the recent autumn. In conclusion, before offering the accompanying remarks on certain injurious and beneficial insects, the reporter would invite the attention of agriculturists to those insects that prey on the cranberry crop and other injurious insects, and beg them to communicate to him at

Salem, specimens and information about their habits and extent of ravages which may be of use in making up the next year's report.

INSECTS INJURIOUS TO THE STRAWBERRY.

The May Beetle.—With the increasing attention paid to the culture of the strawberry, it has been found that several insects not before suspected to be inclined to feed on this plant, now habitually frequent it. Of these perhaps the most injurious is the strawberry saw-fly, which in this state, but more especially the western states, as in Illinois, does in some cases the most grievous damage. Then a few moths which have been known to feed on fruit-trees, the currant, etc., have transferred their affections to the strawberry; such are the apple-leaf-roller or *Tortrix*, the saffron measuring-moth (*Angerona crocataria*), and several other caterpillars found in the western states, and described in the entomological reports of Messrs. Walsh and Riley, and also in "Harris's Treatise on the Injurious Insects" of this state, and the reporter's "Guide to the Study of Insects."

Next however in importance to the strawberry saw-fly (*Emphytus maculatus*), is one of the most common and familiar of all these insects which everywhere force their attention upon us. This is the common May beetle, June beetle or "dor bug," the American representative in its abundance and injurious qualities of the European cockchafer.

Dr. Harris has given a brief sketch of its habits and transformations in his "Treatise," and referred to the injury the grub, sometimes called "white-worm," does to the roots of grass, remarking that "in many places the turf may be turned up like a carpet in consequence of the destruction of the roots." He however does not say that it attacks the strawberry-roots, which it has for several years been known to do in gardens about Salem. My attention was especially called to its ravages by Mr. D. M. Balch, of Salem, who has lost many strawberry-plants by the white grub. It seemed evident that they were introduced in the manure placed around the roots, as during July and late in summer, a manure-heap near by swarmed with the well-known white grubs, in various stages of development, some apparently in the second year and others in the third year's growth. They eat the main roots of the plant, thus destroying one plant after an-

other. From this it will be obvious that if we observe the plant to wilt and suddenly die, we may look for the white grub and at once kill it to prevent farther ravages. It is evident, so large and voracious are these worms, that one plant would be a mere trifle to one of them.

It also eats down in much the same manner young squash-plants, as I am told by Mr. C. A. Putnam, of Salem, who has been obliged to plant the seed over once or twice. They attack young plants at the time when they have thrown out three or four leaves. It is obvious that in dealing with this destructive insect we must become familiar with its habits. Every one knows the larva or grub of this insect, so that a detailed description is not necessary. It is a large, soft-bodied, thick, white worm, nearly as large as the thumb. Its head is yellowish or pale horn-colored. Its skin is so thin and transparent that the air-vessels and viscera can be seen through it, while, though it has three pairs of legs, it is so gross and unwieldy that it lies, when dug out of its retreat, flat upon its side.

How many years the grub lives before changing into the beetle we do not know, but probably at least three. It arrives at maturity in the autumn, and early in May in this state the chrysalis may be found in little rude cells or chambers about six inches under the mould, in which position we have found it in Maine late in May. During the latter part of May and early in June, *i. e.* for about a month, it flies about at night, especially on warm nights. By day it hides in fruit and other trees, clinging to the underside of the leaves by its long, curved claws, which are admirably adapted for the purpose. Here it does at times much injury, especially, as Harris remarks, to cherry-trees.

Where it lays its eggs is not definitely known, but it is probable that it burrows in the soil and there lays its eggs, as does the European cockchafer, of whose habits Harris gives a summary, and also the goldsmith beetle, of which we give an account farther on. Riley however says that "soon after pairing, the female beetle creeps into the earth, especially wherever the soil is loose and rough, and after depositing her eggs to the number of forty or fifty, dies. These hatch in the course of a month, and, the grubs growing slowly, do not attain full size till the early spring of the third year, when they construct an ovoid chamber, lined

with a gelatinous fluid; change into pupæ, and soon afterwards into beetles."

In the autumn at the approach of cold it descends to a considerable depth below the surface to avoid the frost, probably about two feet below the usual depth at which the ground is frozen in the winter. At the approach of warm weather, however, it makes its way up near the surface, where it forms a slight cell by wriggling about, and then passes into the pupa state. It is said to sometimes pupate and appear in the winged state in the autumn.

As to remedies against this grub, the careful gardener will in the first place destroy all those that he sees by crushing them to death. When the manure is spread over the strawberry bed he must watch it narrowly for the grubs so easily seen, and kill them. When a vine is seen to die down suddenly in summer he must then dig around the roots and search for them, and go over the bed carefully, even if help has to be employed. It is better to spend even much time and money for two or three years in succession, in endeavoring to exterminate these grubs, than to yield passively to the scourge. The remarks of Mr. Lockwood that we reprint in our account of the goldsmith beetle are eminently practical as applied to this insect. As for special remedies, we have none to propose. Watchfulness and care in culture are better than any special nostrums.

Undoubtedly the natural enemies of this grub are many, but we have no observations bearing on this point. A fungus attacks the grubs in certain seasons, often in considerable numbers. We have received specimens from Missouri of dead and dried grubs, with a long stem growing out from them, the result of the attacks of this fungus. It has been figured by Mr. Riley, who states that another fungus attacks this worm in Virginia. It is well known that caterpillars and even the common house-fly are sometimes attacked by a fungus which replaces the animal portion with its own vegetable substance.

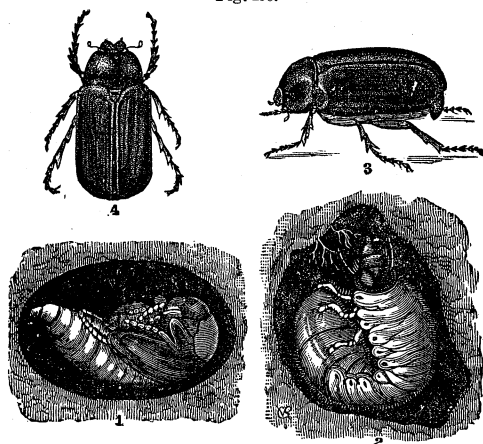
While many animals, such as skunks, moles, crows, etc., prey on the beetles, the only insect enemy I have personally observed is the fierce carnivorous *Calosoma* beetle (*C. calidum*) which I have noticed on a blueberry bush busily engaged in tearing open the hard, horny sides of one of these beetles, which was in vain

struggling to escape; on taking up the May beetle a large hole had been eaten into its side disclosing the viscera.

Occasionally the beetles appear in immense numbers. It is then the duty of the agriculturist to pick them off the trees and burn them. If the French take the pains to practise hand-picking, as in one instance "about eighty millions were collected and destroyed in a single portion of the lower Seine" (Riley), our gardeners can afford to take similar pains.

A description of the May beetle is scarcely necessary. The admirable figure, taken from Harris' work (fig. 138), gives a good

Fig. 138.



May Beetle and young.

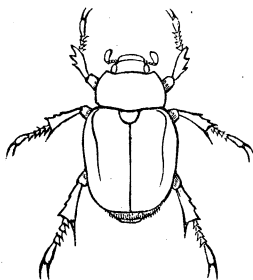
idea of its appearance and size. It is bay colored, or chestnut and brown, with yellowish hairs beneath, and is nearly an inch in length. Its scientific name is *Lachnosterna fusca*, or, literally translated, the brown woolly-breasted beetle. The pupa is white.

The Goldsmith Beetle.—We also have in this state an insect

allied to the preceding, and with much the same habits, both in the adult and preparatory states. It is the *Cotalpa lanigera* (fig. 139). It is nearly an inch in length, bright yellow above, with a golden metallic lustre on the head and thorax, while the under side of the body is copper-colored, and densely covered with white hairs.

Dr. Harris says that it is very common in this state, remarking that it begins to appear in Massachusetts about the middle of May, and continues generally till the twentieth of June. "In the morning and evening twilight

Fig. 139.



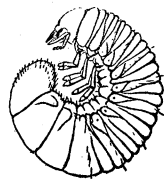
Goldsmith Beetle.

they come forth from their retreats, and fly about with a humming and rustling sound among the branches of trees, the tender leaves of which they devour. Pear trees are particularly subject to their attacks, but the elm, hickory, poplar, oak, and probably also other kinds of trees, are frequented and injured by them." Dr. Lockwood has found it on the white poplar of Europe, the sweet-gum, and has seen it eating the Lawton blackberry. He adds that the larvæ of these insects are not known; probably they live in the ground upon the roots of plants.

It has remained for the Rev. Dr. S. Lockwood to discover that the grub or larva of this pretty beetle in New Jersey devastates strawberry beds, the larva feeding upon the roots, in the same manner as the May beetle. His account was first published in the *AMERICAN NATURALIST* (vol. ii, pp. 186, 441). He says that in the month of May in the ordinary culture of his garden the spade has turned up this beetle generally in company with the May beetle. He found that some of the beetles, as in the case of the May beetle, assume the adult beetle state in October and remain underground for seven months before appearing in the spring.

Larva. The larvæ (fig. 140) he describes as "whitish grubs, about one inch and three-quarters long and over half an inch thick, with a yellowish-brown scale on the part corresponding to the thorax." I may add that it so nearly resembles the young of the May beetle that it requires a close examination to tell them apart. The proportions of the two are much the same; if anything the *Cotalpa* is slightly shorter and thicker, and its body is covered with short, stiff hair, especially at the end, while in the May beetle the hairs are much finer, sparse, and the skin is consequently shiny. They also differ in the head, being fuller, more rounded in *Cotalpa*, the clypeus shorter and very convex, while in the May beetle it is flattened. The upper lip (labrum) is in *Cotalpa* longer, more rounded in front and narrower at the base, and full convex on the surface, while in the young May beetle it is flat. The antennæ are longer and larger in the goldsmith beetle, the second joint a little over half as long as in *Cotalpa*, while in the May beetle grub it is nearly three-quarters as long; the third joint is much longer than in the latter grub, while the fourth and fifth are of the same relative length as in the May beetle, but much thicker. The jaws (mandibles) are much alike in both, but not quite so acute in the *Cotalpa* as in the other, nor are the inner teeth so prominent. The maxilla is much longer and with stouter spines, and the palpi are longer and slenderer in the grub of *Cotalpa* than in the other, though the joints have the same relative proportion in each; the basal joint is nearly twice as long as in the May beetle. The under lip (labium) is throughout much longer, and the palpi, though two-jointed in each, are much longer and slenderer in the grub of *Cotalpa* than in that of the May beetle. The feet are much larger and more hairy in the *Cotalpa*. Both larvæ are about an inch and a half long, and a third (.35) of an inch thick at the widest part.

Fig. 140.



Larva of the Goldsmith Beetle.

As regards the number of years in the life of this insect, Dr.

Lockwood remarks that "when collecting the larvæ in May, I often observed in the same places grubs of the *Cotalpa* of at least four distinct ages, each representing a year in the life of the insect, judging from Renny's figures of the larvæ of the English cockchafer, or dor beetle (*Melolontha vulgaris*). But the cockchafer becomes an imago in January or February, and comes forth into active life in May, just four years from the deposit of the egg. Supposing our *Cotalpa* to take on the imago form in autumn, and to spend its life from that time to the next May in the ground, it would be five years old when it makes its début as an arboreal insect." It is possible that Dr. Lockwood may be in error regarding the age of this beetle, as M. T. Reiset says in France this insect is three years in arriving at its perfect beetle state. The following remarks on the habits of the European chafer may aid observers in this country in studying the habits of our native species. M. Reiset says (see "Cosmos" as translated in the AMERICAN NATURALIST," vol. ii, p. 209) "that this beetle in the spring of 1865 defoliated the oaks and other trees, while immense numbers of their larvæ in the succeeding year, 1866, devoured to a fearful extent the roots of garden vegetables, etc., at a loss to the department of the lower Seine of over five millions of dollars. This insect is three years in arriving at its perfect beetle state. The larvæ, hatched from eggs laid by the beetles which appeared in such numbers in 1865, passed a second winter, that of 1867, at a mean depth in the soil of forty one-hundredths of a metre, or nearly a foot and a half. The thermometer placed in the ground (which was covered with snow) at this mean depth, never rose to thirty-two degrees F. as *minimum*. Thus the larvæ survived after being perfectly frozen (probably most subterranean larvæ are thus frozen, and thaw out in the spring at the approach of warm weather). In June, 1867, the grubs having become full fed, made their way upwards to a mean distance of about thirteen inches below the surface, where, in less than two months, they all changed to the pupa state, and in October and November the perfect beetle appeared. The beetles, however, hibernate, remaining below the surface for a period of five or six months and appearing in April and May. The immature larvæ, warned by the approaching cold, began to migrate deep down in the soil in October, when the temperature of the earth was ten degrees above zero. As soon as the snow melted they gradually rose towards the surface."

As regards the time and mode of laying the eggs, we quote from Dr. Lockwood as follows: "On the evening of the 13th June last we caught in the drug-store, Keyport, whither they were attracted by the profusion of light, four *Cotalpas*, representing both sexes. These were taken home and well cared for. On the 16th a pair coupled. A jar of earth was at once provided, and the beetles placed on top of the dirt. In the evening the female burrowed and disappeared. Near midnight she had not returned to the surface; next morning she had reappeared. The earth was then very carefully taken from the jar, and, as removed, was inspected with a glass of wide field but low power. Fourteen eggs were found, not laid (as we expected) in one spot or group, but singly and at different depths. I was surprised at their great size. Laid lengthwise, end touching end, two eggs measured very nearly three-sixteenths of an inch. They were like white wax, semi-translucent; in form, long-ovoid and perfectly symmetrical. On the 13th of July one had hatched; the grub was well formed and very lively. Its dimensions were about five-sixteenths of an inch in length and about three-thirtieths of an inch in thickness. It was a dull white, the head-plate precisely that dull yellow seen in the adult grub, the legs the same color, and the extremity of the abdomen lead-color, the skin being transparent. For food, a sod of white clover (*Trifolium repens*) was given them, roots downward, knowing that the young larvæ would come upward to eat. They were then left undisturbed until August 19th, when the sod was removed, and it was found that the grubs had eaten into it, thus making little oval chambers, which were enlarged as the eating went on. They were carefully picked out and a fresh sod of grass and clover supplied. They had now grown five-eighths of an inch in length, preserving the same colors.

It is quite possible that a few of the eggs escaped me in the search. I am of opinion, however, that from fifteen to twenty is the average number laid by one beetle. In short, the insect lays her eggs in the night, probably not more than twenty. The hatching of these required in the present instance twenty-seven days. It must be remembered that a large portion of this time was remarkably cold and wet. It is almost certain that with favorable thermal conditions this might be lessened fully seven days.

Regarding its ravages in strawberry beds, I cannot do better than quote from Dr. Lockwood's excellent account in the AMERICAN NATURALIST: "When on a visit in September last to the farm of a celebrated strawberry grower in Monmouth county, N. J., my attention was directed to certain large patches badly thinned out by, as the phrase went, 'the worm.' The plants were dead on the surface and easily pulled up, the roots being eaten off below. It was observable that the fields which presented the worst appearance were all of the same kind of plant,—that known as Wilson's Albany Seedling. Besides this there were nine other varieties under culture,—Barnes' Mammoth, Schenck's Excelsior, the Agriculturist, Triomphe de Gand, Cutter's Seedling, the Jucunda, Pine-apple, Early Scarlet and Brooklyn Scarlet. While the Wilson stood second to none of these as a prolific fruit-bearer, yet it fell behind them in vigorous plant-growth. Hence, while every kind was more or less affected, the other varieties seemed saved by their own growth and energy from a destruction so thorough as was that of the Wilson. These patches were all planted in the spring, and all received the same treatment, the ground being kept open and free from weeds. The amount of the spring-planting was seven and a half acres. Of the Wilsons there were three different patches in places quite separated from each other, and on not less than five different kinds of soil. These patches were among and contiguous to those of the other varieties. While all suffered more or less, the chief injury befell the Wilsons, of which not less than two acres were irretrievably ruined. An examination turned up the depredator, who was none other than the larva of the goldsmith beetle, now engaged in the first one of its allotted three-summer campaigns of mischief. These grubs were from the eggs deposited in June in the well-tilled and clean soil, which, I have said elsewhere, I thought the *Cotalpa* preferred to meadow or grass lands. Compared with others, the larva of this beetle is sluggish and easily captured. The black grub of the spring, which is such a pest, attacking almost indiscriminately the early tender plants, inflicts its injuries chiefly in the night, the exception being that of dull and cloudy days. The night's mischief done, it descends into concealment at early dawn. Knowing this, the wise farmer is in search of it at an early hour, ere the warmth of the sun gives it warning to retreat. But the goldsmith grub can be taken at any hour of the day simply by scratching away

the earth from around the roots of those plants whose dark, shrivelled leaves tell of the enemy's presence. It is my belief that this devastation might have been spared by an outlay of from \$20 to \$30 for labor, much of which, under proper direction, could have been done by children. Therein would have been saved a strawberry crop for the ensuing summer, worth scarcely less than \$2,500, for from this same farm the crop of a single acre has been sold for \$1,500. Then, however valuable such labors are in the immediate results, that is but a fraction of their worth as respects the future. These *Cotalpa* grubs, with all their mischief, had not more than a third of their ultimate size; hence their real ravensousness is yet to come. Besides, what a prospect of increase of numbers, should even a moderate share of them reach maturity! Why should not our farmers seek to know something about their insect-enemies, and when practicable put forth some energy to meet such?"

Snails Injurious to the Strawberry.—Under this caption Prof. E. T. Cox publishes in the AMERICAN NATURALIST (vol. ii, p. 666) a note regarding the injury done in Indiana by a little snail (*Pupila fallax*), at present found occasionally though not abundantly in this state. Though this report refers chiefly to insects, yet in the future, as civilization advances and the country becomes more thickly settled, gardeners are undoubtedly destined to be plagued by these little animals, and a slight notice of them may not be out of place, as the ravages they commit may be sometimes wrongly attributed to insects.

It seems that Mr. and Mrs. Chappelsmith of New Harmony, Indiana, "found their strawberry plants dying rapidly, and on seeking for the cause discovered these mollusks at work upon the stems and crowns of the plants, rasping off the outer coating, and sucking their juices in such a manner as to cause them to decay. Mr. C. found as many as forty upon one plant, and thinks they have killed several thousand upon the different beds. Though more abundant on the strawberry, he has found them on a variety of plants. Since attention has been called to the depredations of these minute mollusks, they have been found at work upon the strawberry plants in all the gardens examined."

Though this species is not common with us, yet we have other kinds which are more or less so, and which may ultimately prove to be obnoxious. Yet it is not probable that snails will ever be

so abundant with us as in Europe, as our climate is much drier and hotter, snails needing a damp, rainy climate in order to flourish vigorously.

INSECTS INJURING THE BEAN.

The Bean-weevil.—In our article entitled “Injurious Insects New or Little Known,” published in the Report of the Board of Agriculture for 1870, we described and figured the bean-weevil, which was then regarded as an imported species, the European *Bruchus granarius*, and some account was given of its habits. Afterwards in a short note published in our First Annual Report (p. 22), we stated that it was not an importation, but a native species which for some years has been known to be injuring the bean in New York and the Middle States. It was mentioned under the unpublished or manuscript name of *Bruchus varicornis* (Leconte). The same year Mr. Riley described it in his report on the injurious insects of Missouri under the name of *Bruchus fabæ*, and states that it appeared about ten years ago (1862) in Rhode Island, according to Mr. F. G. Sanborn, and is now known to appear in Illinois and Missouri.

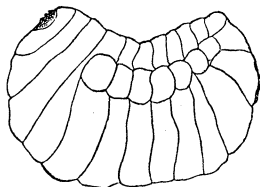
How extremely injurious this weevil has been, and still threatens to be, appears from both Mr. Riley’s and my reports. We are sorry to add that this winter it is said to be very abundant in seed-stores in Boston, and unless checked in its course, a comparatively easy thing to do at this time, it will rapidly spread all over the state, and do incalculable injury to the bean crop.

I am indebted to Mr. C. A. Putnam, of Salem, for numerous living specimens of this weevil, with the beans from which they were emerging, obtained by him at a seed-store in Boston in February. We have figured, in our report for 1870, the bean perforated by the grubs. It is easy to tell by the little round dark spot on the outside of the bean, *i. e.*, the thin covering over the hole in which the weevil lies, whether the weevil lies within. Now is the time to plunge all the beans in hot boiling water to kill the weevils—treating them just as gardeners have been accustomed to deal with the well-known pea-weevil. Such beans as are found to be affected should at once be burned. Again, as suggested by Dr. Harris, in dealing with the pea-weevil, “if the peas are kept till they are a year old, the insects will leave them.” So that by keeping the seed for two years in tin boxes, or other dry situa-

tions, where the weevil may come out and die, without being allowed to go at liberty, the beans may be sown with impunity. By the exercise of a little care, and by combination among gardeners this pest may be kept under.

Larva. The grub or larva occurred February 10th in different stages of growth, the largest being one-seventh ($\cdot14$) of an inch long and about half as thick ($\cdot08$). Other grubs were only half as long. Some chrysalides occurred also at this date while the adult beetles were coming out of the beans. The larva is a very thick, white, fleshy grub (fig. 141) with the body much curved and the head very minute and sunken in the body. The rings are much flattened, the sutures obscurely marked, and the rings are each divided by a transverse line separating it into two portions. There is a distinct, flattened, lateral ridge. The end of the body is much rounded and incurved. The head is white, becoming honey-yellow about the short, stout jaws.

Fig. 141.



Grub of Bean-weevil.

One specimen was in the semi-pupa state, being intermediate between the larva and pupa. Its body was straightened out, the head being at the extreme end and now quite prominent, while before it was hidden in the soft body. The three succeeding segments were full and swollen, the third being very distinct from the succeeding one, the basal abdominal segment. The whole body was much flatter and thinner than in the grub. It was evident that the remarkable changes by which it becomes transformed into the chrysalis state had begun.

INSECTS INJURIOUS TO FRUIT AND FOREST TREES.

The Seventeen-year Locust.—This remarkable insect having, after its long absence of seventeen years, again, as had been predicted by observers, made its appearance in the southerly parts of the state, we take this occasion to draw attention to its strange and unwonted habits, and to solicit aid from observers in the state in determining its natural boundaries. I should be greatly obliged if any persons in every town in the state in which it appeared would let me know of the fact, that we may ascertain its range. While it has been known to appear in the southeastern part of the state, and even as far east as Plymouth, situated on Massachusetts Bay, we want to know in what towns to the north of this it has appeared. The point is of much interest to naturalists, as in determining the northern boundary of the district it inhabits, which undoubtedly accords with certain lines of temperature which regulate the distribution of many other insects and plants, it may throw much light on the physical geography and meteorology of our state. The cicada also often does much injury to fruit-trees, especially in the West, and it is thus, aside from its deeply interesting and unique mode of life, an object of solicitude to farmers.

The most remarkable fact about this creature is that, while so far as we know, the other species of cicada pass but a year in attaining the winged state, the present one lives underground over sixteen, assuming at the end of seventeen years the perfect winged state. We have seen that the May beetle is about three years in obtaining the beetle state, and the wire-worms and boring-beetle, such as the apple-borer, may be four or five years in the larval condition, but no other insects are as yet known, with this sole remarkable exception, to be so long-lived in their immature state.

The remarks that we have to make are simply supplementary to what the reader may find in Dr. Harris' admirable account in his "Treatise." He brings out the important fact that these insects are said, in the larval state, to do much injury to apple and pear trees by drawing the sap from the roots, so that the tree may decline in health for years without any apparent cause. This needs to be substantiated by farther observation. As regards the kinds of this I may quote from a communication from William Kite in the *AMERICAN NATURALIST*, vol. ii, p. 442, as confirming and adding somewhat to Dr. Harris' statements: "Seeing in the July number of the *NATURALIST* a request for twigs of *oak* which had been stung by the so-called seventeen-year locust, I take the liberty of sending you twigs from *eleven* different varieties of trees in which the females have deposited their eggs. I do this to show that the insect seems indifferent to the *kind* of wood made use of as a depository of her eggs. These were gathered July 1st, in about an hour's time, on the south hills of the 'Great Chester Valley,' Chester county, Pa. No doubt the number of trees and bushes might be much increased. The female, in depositing her eggs, seems to prefer well-matured wood, rejecting the growing branch of this year, and using the last year's wood and frequently that of the year before, as some of the twigs enclosed will show. An orchard which I visited was so badly 'stung' that the apple trees will be seriously injured, and the peach trees will hardly survive their treatment. Instinct did not seem to caution the animal against using improper depositories, as I found many cherry trees had been used by them, the gum exuding from the wounds, in that case sealing the eggs in beyond escape.

"The males have begun to die, and are found in numbers under the trees; the females are yet busy with their peculiar office. The length of wood perforated on each branch varied from one to two

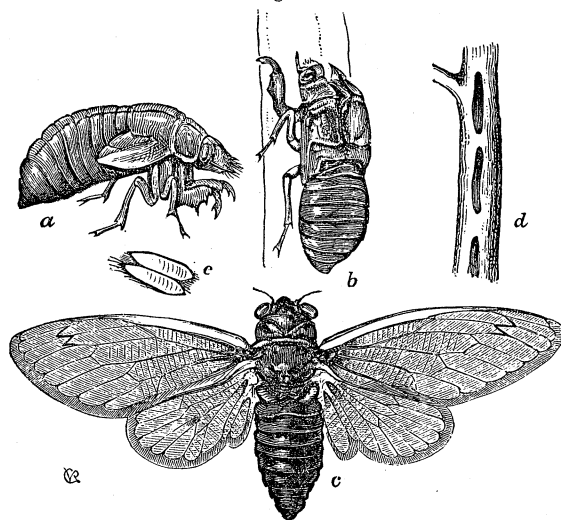
and a half feet averaging probably eighteen inches ; these seemed to be the work of one insect on each twig, showing a wonderful fecundity.

“The recurrence of three ‘locust-years’ is well remembered in this locality—1834, 1857 and 1868. There has been no variation from the usual time, establishing the regularity of their periodical appearance.”

As regards the time and mode of hatching, Mr. S. S. Rathvon of Lancaster, Pa., contributes to the same journal some new and valuable facts, which we quote : “With reference to the eggs and young of the seventeen-year cicada, your correspondent from Haverford College, Philadelphia, is not the only one who has failed to produce the young by keeping branches containing eggs in their studios. I so failed in 1834 and 1851, and indeed I have never heard that any one has succeeded in that way, who has kept them for any great length of time. In the brood of 1868, the first cicadas appeared here in a body, on the evening of the second day of June. The first pair *incoitu*, I observed on the 21st, and the first female depositing on the 26th of the same month. The first young were excluded on the 5th of August. All these dates are some ten days later than corresponding observations made by myself and others in former years. On the 15th of July I cut off some apple, pear and chestnut twigs containing eggs, and stuck the ends into a bottle containing water, and set it in a broad, shallow dish also filled with water, the whole remaining out of doors exposed to the weather, whatever it might be. The young continued to drop out on the water in the dish for a full week, after the date above mentioned. I could breed no cicadas from branches that were dead and on which the leaves were withered, nor from those that from any cause had fallen to the ground, and this was also the case with Mr. Vincent Bernard, of Kennet Square, Chester county, Pa. After the precise time was known, fresh branches were obtained, and then the young cicadas were seen coming forth in great numbers, by half a dozen observers in this county. As the fruitful eggs were at least a third larger than they were when first deposited, I infer that they require the moisture contained in living wood to preserve their vitality. When the proper time arrives and the proper conditions are preserved, they are easily bred, and indeed I have seen them evolve on the palm of my hand. The eyes of the young cicadas are seen through the egg-skin before it is broken.”

Mr. Riley, in an interesting account of this cicada in his "First Annual Report on Noxious, Beneficial, and other Insects of Missouri" for 1869, has shown that in the southern states thirteen-year broods of this insect are found. He remarks: "It was my good fortune to observe that besides the seventeen-year broods, the appearance of one of which was recorded as long ago as 1633, there are also thirteen-year broods, and that, though both sometimes occur in the same states, yet in general terms, the seventeen-year broods may be said to belong to the northern and the thirteen-year broods to the southern states, the dividing line being

Fig. 142.



The Seventeen-year Cicada and Pupa.

about latitude thirty-eight degrees, though in some places the seventeen-year brood extends below this line, while in Illinois the thirteen-year brood runs up considerably beyond it. It was also exceedingly gratifying to find, four months after I had published this fact, that the same

discovery had been made years before by Dr. Smith, though it had never been given to the world."

Mr. Riley predicts that in southern New England a brood will appear in 1877 and 1885. Probably the Plymouth brood which appeared in 1872, will not appear again for seventeen years, namely, in 1889, the two broods noticed by Riley appearing west of this town. As regards its appearance in Plymouth, in this state, Harris states that it appeared there in 1633. The next date given is 1804, "but, if the exact period of seventeen years had been observed, they should have returned in 1803."

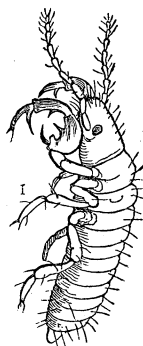
Mr. B. M. Watson informs me from his personal observation,

that it also appeared in 1838, 1855 and 1872. In Sandwich it appeared in 1787, 1804 and 1821. In Fall River it appeared in 1834; in Hadley in 1818; in Bristol county in 1784, so that as remarked by Harris and others it appears at different years in places not far from each other. So that while in Plymouth and Sandwich we may look for its reappearance in 1889, in Fall River it will come in 1885, or four years earlier.

There are three species of cicada in this state, and in order that they may not be confounded in studying the times of appearance of the different broods of the seventeen-year species I add a short description of each form, so that they may be readily recognized in the winged and immature states.

The two largest species are the seventeen-year locust (*Cicada septendecim*) and the dog-day cicada (*C. pruinosa*). Fig. 142, copied from Riley's report gives a good idea of this species: *a* represents the pupa; *b* the same after the adult has escaped through the rent in the back; *c* the winged fly; *d* the holes in which the eggs *e* are inserted. Fig. 143 represents the larva as soon as hatched. The adult may be known by its rather narrow head, the black body and bright red veins of the wings. The wings expand from two and a half to three and a quarter inches.

Fig. 143.



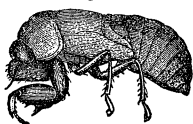
Larva of Seventeen-year Cicada.

The pupa is long and narrow, and compared with that of *C. pruinosa* the head is longer and narrower, the antennæ considerably longer, the separate joints being longer than those of the dog-day locust. The anterior thighs (femora) are very large and swollen, smaller than in *C. pruinosa*, though not quite so thick, with the basal spine shorter than in that species, while the snag or supplementary tooth is larger and nearer the end; the next spine, the basal one of the series of five, is three times as large as the next one, while in *C. pruinosa* it is of the same size, or if anything smaller. The toe-joint (tarsus) projects over two-thirds of its length beyond the end of the shank (tibia), while in the other species it only projects half its length. The terminal segment of the body is rather larger than in *C. pruinosa*. The body is shining gum-color or honey-yellow, with the hinder edge of the abdominal segments thickened, but no darker than the rest of the body. Length one inch (.90-1), width about a third of an inch (.35) being rather smaller than that of *C. pruinosa* and much larger than that of *C. rimosa*.

The dog-day harvest-fly may at once be known by its large head, as wide as the body, and by the green markings on the head and thorax, especially the W-shaped mark on the latter. It expands three inches, and is a larger and more bulky insect than

the preceding. We know but little of its habits. Harris says that it invariably appears with the beginning of the dog-days, and in the vicinity of Boston he has heard it for many years in succession, with only one or two exceptions, on the 25th of July, for the first time in the season. According to Prof. A. E. Verrill, in our "Guide to the Study of Insects," it lays its eggs in the stems of the solidago or golden rod. "It made a longitudinal incision with ragged edges into the pith of the plant, then with its ovipositor forced its eggs a little distance down into the pith below the external opening: there were two rows of eggs succeeding

Fig. 144.

Pupa of *Cicada pruinososa*.

the first single one, each pair diverging outwards, the lower ends of each pair nearly touching each other, and all placed very near together."

The pupa (fig. 144) is much the largest and thickest of the three species, being nearly twice as bulky as that of the two others. The head is very broad, short, triangular, much shorter than in the seventeen-year locust. There are no dark bands crossing the body. It is an inch in length and nearly one-half ($\frac{1}{2}$) an inch wide.

One smaller species, the least cicada (*C. rimosa*), expands a little less than two and a half inches, and has a narrow head, with bright red markings on the head and thorax. For several years in Brunswick, Maine, I have noticed that it began its song on the 10th of June, and in this state it probably sings by the 1st of that month.

Its pupa (fig. 145) is in most respects intermediate between the first two species. The head is broadly triangular, like that of *C. pruinososa*. The antennæ have shorter and smaller basal joints, and not much larger than the second, while they are very unequal in size in the two other species; the third joint is much shorter than that of *C. septendecim*. The front of the head is much more hairy than in the others. The thorax is shaped much as in *C. pruinososa*, but the insect differs from both species in having a broad, dark brown conspicuous band on the hinder edge of each thoracic and abdominal ring.

Fig. 145.

Pupa of *Cicada rimosa*.

The anterior femora are rather shorter than in the other species, but on the whole more like those of the seventeen-year cicada than the *C. pruinososa*. The spines are large and heavy; the basal one like that of *C. pruinososa*, but rather shorter and broader, with the tooth situated nearer the base. Of the five inner teeth the first one is twice as large as the second. Near the end of the tibiae are two well-marked teeth, much more distinctly marked than in the other two species, which have but one low appressed tooth in their place. The tarsus projects about a third of its length beyond the tip of the tibia. Length .80, breadth .35 inch.

The Brachys Leaf-miner.—This and the following beetle have the singular habit of mining the leaves of plants. It is rarely that beetles live this sort of life, though many caterpillars and

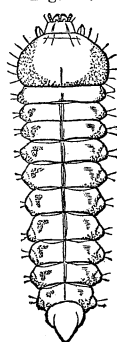
maggots of flies are leaf-miners. Dr. Harris has given in his "Treatise" an account of the larva of *Hispa* which mines the leaf of the apple tree, eating the pulpy substance between the upper and under surface of the leaf. The two insects of which we now treat belong to the family of Buprestids, several species of which do much injury to our fruit and shade trees in the grub state. They are footless grubs and recognized by the broad, rounded, flattened segment just behind and partially enclosing the head. The young of the following insects depart somewhat from this typical form owing to their peculiar leaf-mining habits. The first of these is the young of the *Brachys aeruginosa* which has been found by V. T. Chambers, Esq., of Covington, Ky., mining the leaves of the beech tree, and I am indebted to him for a specimen of the larva here figured (Fig. 146).

I may remark here that a closely allied beetle (*B. terminans*), I have often found resting in the leaves of the oak and beech. The beetles of this genus are flattened, angular ovate, and less than a quarter of an inch in length, and the scutellum is small, as Leconte observes, while the shanks (tibiæ) are linear. In the succeeding genus, *Metonius*, Leconte says that the body is triangular, while the scutellum is large, and the shanks are dilated.

Larva. The body of the larva is rather long, with the segments very deeply cut, being flattened, and produced laterally into a triangular projection, giving a serrate outline to the body, the teeth being obtusely rounded. The segment next behind the head is the widest, the succeeding segments gradually decreasing in width and increasing slightly in length to the end. The terminal segment is about half as wide as the body in its widest portion, and is somewhat triangular, with the sides parallel, and the tip obtusely pointed. The prothoracic segment or the one next the head is broader than long, and has a fleshy projection on each side at the base of the head. On the upper side of this segment is a large, square, slightly horny area. The head is anteriorly pale honey yellow, with two dark longitudinal parallel lines; the horny portion is about as long as broad, much flattened, subtriangular. The antennæ are very minute, slender, three-jointed, with the joints nearly equal in length. The jaws and palpi are so minute that a description will be of no practical use here. The body is finely shagreened, with a few fine scattered hairs. It is whitish, with a slight greenish tinge, and a quarter ($\cdot 25$) of an inch long, and less than a tenth ($\cdot 07$) of an inch broad. It was sent to me alive in September.

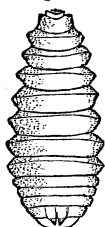
The Tick Trefoil Leaf-miner.—This insect (*Metonius lævigatus*) which is not uncommon in this state, has been found by Mr. V. T. Chambers of Covington, Ky., mining the leaves of the tick trefoil (*Desmodium*) during the early part of September. The larva is from $\cdot 15$ to $\cdot 20$ inch in length, and mines a broad, irregular patch,

Fig. 146.

Larva of
Brachys.

sometimes only half the length of the leaf, but often it extends its burrow around the end of the midrib, half way down the other side of the leaf. The track of its burrow is irregularly sin-

Fig. 147.

Larva of
Metonius.

uous. At the end of this gallery or burrow it forms a round chamber just as wide as the body is long, disk-shaped, the walls being convex, the cell looking like a smooth, regular blister.

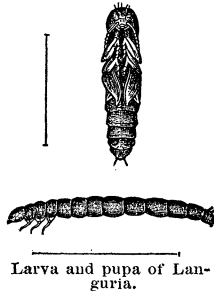
Larva. The grub (fig. 147) differs greatly in form from the preceding one, the body being quite thick, but little flattened, being rather convex above and below; in form oval lanceolate, widest in the middle, tapering much more rapidly posteriorly than toward the head. The segments, especially those of the abdomen, very convex on the sides, being produced triangularly into very acute teeth. The prothoracic ring is about the same width as the fifth abdominal ring, being narrower than the mesothoracic ring and having the sides somewhat sharply pointed, while those of the succeeding (metothoracic) segments are rounded. The eighth abdominal segment, or one next to the last, is transversely oblong, and about two-thirds as wide as the seventh. The ninth and last is a little over one-half as wide as the eighth. It gives rise to a minute projection at the end. The prothoracic segment and head are closely soldered together; the two together are transversely ovate elliptical, full convex on the front edge, the separation between the head and succeeding ring being indicated by a slight notch. The anterior surface of the head is somewhat flattened, with a small, squarish, pale, horny area. The horny portion of the front of the head is very minute compared with the similar part in the *Brachys* larva, and is scarcely perceptible except under high magnifying powers. The body is uniformly pale greenish, and the skin is smooth. The differences between the two larvæ are most remarkable, when we consider how closely the beetles resemble each other.

The Spotted-necked Languria.—This beetle is allied to *Trogosita*, an insect which is known to be injurious to housed grain, though the grub is still more intimately related to the European *Nemosoma elongatum*, which is found under the bark of elms in burrows inhabited by *Hylesinus*, a wood-boring beetle. Having received the *Languria* in all its stages of growth, from Mr. Belfrage of Texas, though the insect occurs in the middle states, it is thought that a description of it will not be out of place in a report on economic entomology, as some members of the group to which it belongs are known to be destructive. The adult beetle was first described by Say (under the name of *Languria puncticollis*) from Ohio. It is pale reddish, with the fore legs, wing-covers and end of the body black, with a large distinct black spot in the middle of the neck (prothorax). It is said by Mr. Say to frequent flowers.

The larva (fig. 148) is unusually long and slender, cylindrical, the body being of uniform thickness throughout, whitish, with smooth segments. The head is but little narrower than the rest of the body; the eighth ring of the abdomen is as large as the rest, while the ninth is much smaller, being rounded and bearing two dorsal, upcurved,

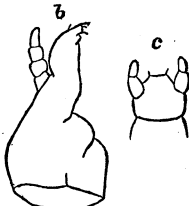
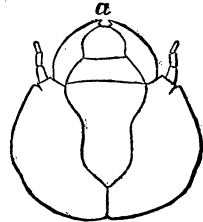
acute hooks. There are a few scattered hairs over the body. The six thoracic legs are well developed, and there is a stout, short, anal prop-leg. As usual there are nine breathing-holes (stigmata) on each side of the body. The head is somewhat flattened, squarish, the postclypeus (as we may call the triangular inclosure in the top of the head), shield-shaped with apex acute, and with two shallow pits (eyes?) on each side of the middle. The true clypeus is short, transverse. The feelers (antennæ) are inserted on the side of the head, and are as long as the clypeus is broad; they are four-jointed, with the third longest, the fourth very slender, not quite so long as the second. Upper lip (labrum) transversely oval, elliptic, the front edge curved, and the surface moderately convex. The jaws (mandibles) are stout, black at tips, three toothed, the upper tooth small, the two lower ones equal. The maxillæ (b) have four-jointed palpi reaching to the end of the closed mandibles; the joints of nearly equal length; the third slender, but scarcely longer than the basal joint. The labium (lower or under lip, c) is small and situated on a long, narrow mentum; the palpi are two-jointed, the joints subequal, the second but a little longer than the first. Length of body, .65; thickness, one-tenth of an inch (50 specimens). The pupa (fig. 149) is white, long and slender, with the club-shaped antennæ reaching to the middle of the anterior tarsi; the tarsi of the middle pair of legs reaching to the hinder edge of the first abdominal segment; hinder pair of legs concealed, with the exception of the femora-tibial joint, by the wing-covers, the latter being long, pointed and ribbed; they reach to the end of the fourth abdominal segment. Near the hind edge of each segment is a dorsal ridge, bearing stiff hairs, and from three to seven unequal sharp spines, which on the sixth segment are arranged in two irregular rows, with six larger than the rest, and tipped with black. On the terminal segment are two large, equal, erect, long and slender blackish spines, and a pair of ventral, sharp tubercles on the seventh segment.

Figs. 148 and 149.



Larva and pupa of Languria.

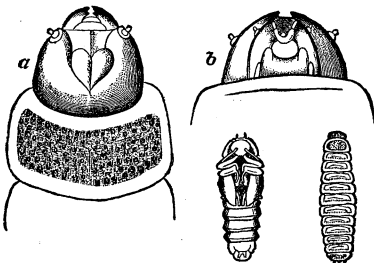
Fig. 149 a.



Head of larva of Languria.

The body is naked, whitish, with a few scattered hairs along the sides. The head cannot be seen from above, being covered by the prothorax; it is rounded oval, and free from the prothorax beneath, with a few short scattered hairs. It is about half (.50-.60) of an inch long. (Thirty specimens.)

Fig. 150.



Larva and pupa of Dacne.

Of probably somewhat similar habits is the *Dacne heros* (fig. 150, larva and pupa; a, upper, b, under side of head), the early stages of which have been communicated to me by Dr. H. Shimer, of Illinois. The

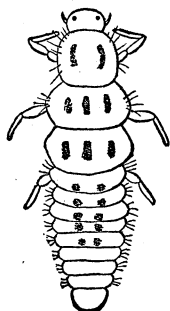
grub of an allied species (*D. fasciata*) found in this state, is said

by Candèze to live about New Orleans in the diseased trunks of the palmetto. It is not known what tree it inhabits in this state.

BENEFICIAL INSECTS.

The Aphis-eating Lady-beetle.—Among the insects which do incalculable benefit to agriculture, are several kinds which prey almost exclusively upon the Aphis or plant-louse. The Syrphus flies in the maggot state devour great quantities, and so do the larvæ of the lace-winged fly (Chrysopa). Scarcely less valuable

Fig. 151.



aids to the gardener are the young of the "Lady-bird" beetle (*Coccinella*). During the past summer we have traced the transformations of a species (*Psyllobora 20-maculata* Say) which lived in all its stages on the leaves of the horse-chestnut during the month of August. As no aphides were seen on the leaves, I am inclined to think that in this instance the food of the young lady-bird was certain freshly hatched Psoci (*Coecilius*), aphis-like neuropterous insects which were running about over the leaves, masses of their eggs being attached to the leaves, and as usual covered with a thin web. Indeed some *Coccinellæ* feed on the eggs and young of their own kind. This lady-bird is a very small beetle, a tenth of an inch long; pale, whitish yellow, including the legs and antennæ. There are four black spots on the prothorax, and nine on each wing-cover, two on each wing cover usually running together, thus making twenty distinct spots in all.

The Larva (fig. 151) is long and slender, with a rather small head, which is a little over half as wide as the segment (prothorax) next to it; it is somewhat trapezoidal in form, being widest in front, a little longer than broad, with black, conspicuous eyes consisting of four or five raised facets. The stout, minute antennæ are two-jointed, the joints being of equal thickness, the second a little shorter than the first. The upper lip (labrum) is small, transversely broad ovate, with the front edge rounded. The jaws are quite small. The maxillæ are very large, obtuse cylindrical, projecting far beyond the head. The labium is small and short.

The body is widest on the third segment behind the head, and shorter than the first segment, the three segments gradually decreasing in length; while the abdominal segments are nearly equal in length, and very convex laterally. The form of the terminal (ninth) segment I could not make out, as all my specimens were preparing to affix themselves to the surface of the leaf, and this segment was greatly enlarged and elongated, ending in a soft and membranous ruffle-like dilatation by which the insect was evidently about to gum itself to the leaf.

The body is covered with short, stiff hairs. It is white, with two dark spots on the segment next the head, four on each of the two following segments, and two on the five

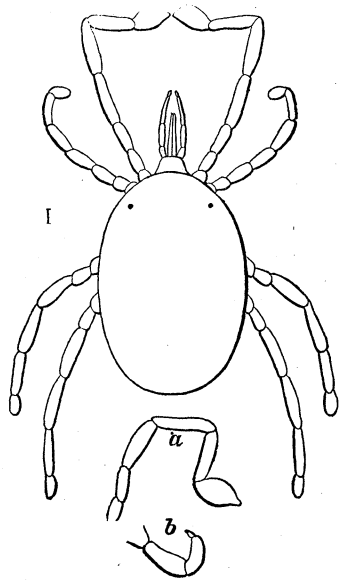
succeeding segments; these spots are thickened portions of the skin, giving rise to hairs. The legs are stout, the toe-joint ending in a single claw, with four or five tenent hairs at the end of the joint. Length about a seventh ($\frac{1}{5}$) of an inch.

The pupa is of the usual form in the group, but is white, with two faint dorsal dark spots on the middle thoracic segment, and two on the basal segment of the abdomen; farther behind is a pair of large, converging, black spots beginning on the second abdominal segment, and ending on the fourth; while on each side of the fourth are two dark spots. There are two slight dorsal spots on the fifth segment. The body is usually provided with a few fine, scattered hairs, but in a very small specimen ($\frac{1}{16}$ inch long) the upper side is densely covered with long, thick hairs, the body being naked beneath. The larger specimen measured $\frac{1}{12}$ inch in length.

The Aphis-eating Mite.—Quite an unsuspected enemy of the aphid is a little garden-mite, which I found in July and August last in considerable numbers in my garden, busily engaged in devouring the plant-lice on the rose-bushes.

We know but little of the numerous kinds of mites which abound in this country, and but few species are known to prey on other insects. The present species is allied to the red garden-mite (*Trombidium*), which is often seen running over flower beds. It is the six-legged young of these mites which, under the name of harvest-mites, are so irritating and annoying when they get upon our bodies, as they work their way in under the skin. Their natural hosts are various insects, such as grasshoppers, etc., as we often perceive them with their heads stuck in between the joints of the latter. They are all vermilion-red in color, and in former times have been used as a dye.

Fig. 152.



Aphis-eating Mite.

Our species is apparently a *Trombidium*, or closely allied genus, and perhaps the specimen we figure here is immature. It may be called *Trombidium? bulbipes* (fig. 152, *a*, leg; *b*, palpus, side view) in allusion to the swollen, bulb-like terminal joints of the legs. It is scarlet red, regularly ovate in form, with a distinct, squarish head separate from the body, and two deep-red eye-spots situated over the insertion of the second pair of legs. The beak is long, slender, sharply conical, and reaches to near the middle of the third joint of the palpi; the latter four-jointed, the second and third joints of nearly equal size, the fourth very minute; when extended the palpi reach nearly to the end of the third joint of the first pair of legs. The fore feet are much

larger, thicker, and rather longer than the fourth pair, and inserted very near the head; the terminal joint is much swollen, ovate, the preceding joint being slenderer than the others. The second pair are about half as long as the first pair. It is deep scarlet-red, and the body and limbs are densely covered with short, stout hairs.

This species, though quite different in the form of the body, yet in the proportions and form of the legs and mouth-parts is congeneric with the European *Trombidium papillosum* of Hermann, which is said to live on the trunks of trees and in moss.

THE RELATION BETWEEN THE COLOR AND THE GEOGRAPHICAL DISTRIBUTION OF BIRDS.

BY ROBERT RIDGWAY.

THE July number of the NATURALIST contains a criticism of my paper on the relation between color and geographical distribution of birds* which is doubtless by this time familiar to the readers of this journal. The tone of this criticism renders it necessary for me to reply to it; but in doing so I shall endeavor to use as little space as possible, and limit my defence to the statement of a few simple truths, which I hope will answer the purpose as well as a lengthy discussion.

The specific charges made against me are two in number: (1) I am accused of "appropriating Mr. Allen's work without acknowledgment" to the latter author; and (2) of dishonestly claiming originality in the conception of certain laws and of cases illustrating them. These charges are preferred severally in the following words: — "he writes as if his views were both novel and original, which is not the case. To speak plainly, the paper is based entirely upon Mr. Allen's views, without the slightest allusion to this author; and is illustrated chiefly by cases already published, yet without proper references."

As regards Mr. Allen's work, I am not only willing, but desirous, that he should receive all the credit due him for his well accomplished task of elucidating the laws of climatic color-

* On the relation between Color and Geographical Distribution in Birds, as exhibited in Melanism and Hyperchromism. Am. Journ. Sci. iv, Dec., 1872, p. 454; v, Jan., 1873. p. 29.